

NOTES ON EGG HATCHING—LARVAL, PUPAL,
AND ADULT DEVELOPMENT IN LINA
SCRIPTA (FABR.)

(Coleoptera: Chrysomelidæ)

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Early in June 1930, a twig from a poplar tree was brought into the Stanford entomology laboratory, with a number of the pupæ of the beetle *Lina scripta* (*Melasoma scripta*) hanging to it. On June 14, a number of adults, spotted and black, emerged from these pupæ. A pair of spotted beetles was isolated and placed in a glass jar for the purpose of observation. The pair was supplied continuously with fresh young poplar leaves. Room temperature, during the course of observations, varied from 69 to 70 degrees Fahrenheit.

On June 22, eight days after emergence, the pair mated. On June 26, twelve days after emergence, fifty-nine eggs were deposited on the underside of the leaf. The eggs were attached to the surface by an adhesive secretion in an oblique position, occasionally one lying over the other. They were oval and of a deep yellow color. This was the first of several batches of eggs oviposited by the female.

Hatching began July 2, the period of incubation being thus six days. Just before hatching, the embryo is clearly discernible through the smooth, tough shell. A double row of dorso-lateral black spots, each basal to a single black bristle, is conspicuous. At regular intervals, peristaltic movements of the embryo occur, which, as they become more vigorous, cause the egg shell to split along the side, near the anterior end. As these movements continue, the opening is widened. When the split is quite long, the posterior tip of the abdomen of the larva is drawn forward and under, while at the same time the thorax and first two abdominal segments are pushed against the split in the shell. Each time this "pushing" occurs, the bristles stand erect and the skin becomes turgid.

Conspicuous on the larva are openings of two rows of dorso-lateral glands, two pairs on the thorax and seven pairs on the abdomen. When the larva is disturbed the membrane of the openings of the glands is everted and a secretion with an odor similar to Prussic acid exudes. As the larva is pushing itself through the split in the shell, the skin becomes turgid and this membrane often everts, discharging the milky secretion. As the body relaxes, the membrane is retracted.

The "pushing" continues until the split is widened sufficiently for the extrusion of the larval body. At the tip of the abdomen, there is a sticky disk by means of which the larva attaches itself to the inside of the shell, while the body is erected perpendicularly from this point and moved about in various directions. When pigmentation becomes evident on legs, head, and thorax, the larva curves forward and comes to rest with only an occasional movement, until pigmentation is complete.

Pigmentation takes place by degrees. The mandibles, simple eyes, claws, and bases of the large bristles become pigmented in the embryo. In the larva, the sequence is as follows: thorax, segments of the abdomen, and the tubercles at the openings of the glands.

There are four evident pouches on the thoracic segments adjoining the tubercles. These are very large and soon become yellow and turgid with fluid, while those on the abdomen remain brownish black.

The first moult occurred July 5, the first in-star thus lasting three days. The larvæ, preparing to moult, cease to feed and move in such a way as to indicate that the body is being pulled away from the larval skin. At the same time the four prominent yellow pouches become very light in color. The larval skin splits through the head, thorax, and first abdominal segments. Immediately after ecdysis the larva is yellow and remains inactive until pigmentation sets in and becomes complete.

Three days later, July 8, the second moult occurred. From this time until prepupation the larvæ fed voraciously. Four

days later, July 12, the larvæ ceased feeding, the four yellow pouches became white, and the prepupæ attached themselves to the surface by means of the sticky disk at the tip of the abdomen, with the body suspended. The curved body of the prepupa then straightened out. Soon a split occurred through the cuticle of the head, thorax, and first abdominal segments. The pupa worked its way downward and about two-thirds out of the larval skin, the last three abdominal segments remaining covered by the thoracic region of the exuvia. Here the pupa remained suspended, adhering to the larval integument, and attached to it by a pair of processes on the seventh abdominal segment. These processes fit into pockets on the first abdominal segment of the exuvia, at the base of the paired glands.

The larval glands previously mentioned are of the nature of osmeteria. These have not been studied, but the pouches into which they opened were found to be situated in the larval cuticula and are shed with the exuvia. Here they remain turgid with the fluid with which they are filled throughout ecdysis. Upon pressure, exvagination of the membrane in the throat of the tubercular openings takes place and the fluid flows out through the openings as in the living insect. Upon release of pressure, the membrane mechanically invaginates.

The pupa, upon emergence, is orange-colored underneath, with the rest of the body a light yellow. The sequence of pigmentation is as follows: spiracles of the abdomen, dorsal area of abdominal segments, legs, wing cases, edges of the thorax, and head. At the end of one hour and thirty minutes the pupa became glossy black.

Seven days later, July 19, the first adults emerged. On July 20, all had emerged.

The body of the adult, on emergence, is yellow, with the head, antennæ, legs, and center of the thorax black. The elytra are grayish white with the spots slightly pigmented. The wings are extended until thoroughly dry, when they are folded under the elytra. The lateral margins of the thorax are yellowish white, remaining so for several days, until the adult is finally matured and ready to mate.